

Claims

1. A process for the polymerisation of ethylene and optionally at least one  $C_{3-20}$  alpha olefin comonomer in the slurry or solution phase in a reactor having a polymer outlet stream, a procatalyst or catalyst feed stream and a hydrogen feed stream, said polymerisation being effected in the presence of a metallocene catalyst, a diluent and hydrogen, characterised in that said diluent is recycled from said outlet stream to said hydrogen feed stream, said procatalyst or catalyst feed stream is free of hydrogen, said hydrogen feed stream is free of procatalyst or catalyst and said procatalyst or catalyst feed stream does not comprise recycled diluent.
2. A process as claimed in claim 1 wherein the metallocene catalyst is fed to the reactor.
3. A process as claimed in claim 1 or 2 wherein said process takes place in the slurry phase.
4. A process as claimed in claim 1 to 3 wherein said diluent is propane, n-butane or isobutane.
5. A process as claimed in any one of claims 1 to 4 wherein said metallocene catalyst is supported.
6. A process as claimed in any one of claims 1 to 5 wherein said comonomer is butene, octene or hexene.
7. A process as claimed in any one of claims 1 to 6 further comprising a gas phase polymerisation stage subsequent to said slurry or solution polymerisation.
8. A process as claimed in any preceding claim wherein said metallocene catalyst is prepolymerised.

9. A process as claimed in any one of claims 1 to 8 wherein said catalyst feed stream comprises a catalyst feed vessel in which said metallocene catalyst is resident for at least 2 hours.

5

10. A process as claimed in any preceding claim wherein prior to said process a Ziegler-Natta catalysed polymerisation is effected.

10 11. A process as claimed in claim 10 wherein the change from Ziegler-Natta to metallocene catalysis is effected continuously (i.e. without reactor shutdown) by stopping the feed of Ziegler-Natta catalyst feed and starting metallocene catalyst feed to the reactor.

15

12. A process as claimed in any one of claims 1 to 11 wherein said metallocene catalyst comprises a compound of formula

20  $\text{Cp}'_2\text{MX}'_2$

wherein M is a group 3 to 10 transition metal;

each X' is halogen, diC<sub>1-6</sub>-alkylamido, C<sub>1-6</sub> alkyl, benzyl or hydrogen;

25 each Cp' is a cyclopentadienyl or indenyl group optionally substituted by one or more groups selected from C<sub>1-10</sub> hydrocarbyl or siloxy, said Cp' groups being optionally bridged.

30 13. A process for the polymerisation of ethylene and optionally at least one C<sub>3-20</sub> alpha olefin comonomer in the slurry phase or solution phase in a polymerisation reactor comprising the steps of:

continuously introducing ethylene and optionally at  
35 least one C<sub>3-20</sub> alpha olefin comonomer into said reactor;  
continuously introducing diluent into said reactor;

continuously introducing hydrogen into said reactor;

continuously or intermittently introducing a mixture of diluent and metallocene catalyst into said  
5 reactor;

operating the reactor to form a polymer slurry or solution;

continuously or intermittently removing said polymer slurry or solution from said reactor;

10 subjecting the withdrawn slurry or solution to separation treatment where at least part of the diluent therein is separated from the polymer;

recycling at least part of said separated diluent into the diluent feed;

15 wherein the diluent feed is free of catalyst and said mixture of diluent and metallocene catalyst is free of recycled diluent.

14. Use of at least two feed streams, a first stream  
20 comprising a metallocene catalyst and being free of hydrogen and a second stream comprising hydrogen and being free of metallocene catalyst to prevent metallocene catalyst deactivation in ethylene polymerisation.

25 15. A slurry polymerisation reactor having a polymer slurry outlet, catalyst feed inlet and hydrogen feed inlet, said slurry outlet having a conduit connecting to said hydrogen feed inlet adapted to allow recycling of  
30 diluent from said polymer slurry to said hydrogen feed.